Readers Utilise Proper Noun Capitalisation To Determine Syntactic Class Prior To Direct Fixation

Readers utilise proper noun capitalisation to determine syntactic class prior to direct fixation

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Relative clause processing

- Processing difficulty for Object Relative Clauses (ORCs) is detectable as early as RC subject noun phrase (Staub, 2010)

Processing difficulty (Staub 2010)

The employees that the fireman noticed…

- Can we find processing difficulty on a pre-target region when the noun phrase is a capitalised name, giving readers a strong parafoveal cue of this word's syntactic class?

Processing difficulty?

The thin guard who Charlie alerted…

- This would support theories of language processing as cue integration (Martin, 2016), with implications for other theories.

Similarity-based interference (e.g. Gordon et al. 2001) ORC difficulty due to encoding and storing two NPs prior to VP.

Surprisal (e.g. Levy, 2008): ORC difficulty due to update in probability distribution, given evidence of less frequent structure.

Traxler et al: readers predictively integrate the main clause subject as an active filler, assuming an SRC. In ORCs, this is blocked at RC subject, leading to reanalysis.

Lewis & Vasisth (2005): *early* ORC effects due to unexpected noun after relativizer (given left-corner parser).

Models of oculomotor control

- Models of oculomotor control make predictions about the timing of lexical processing and saccadic programming.
- E-Z Reader (Reichle et al., 2009): Readers program saccade away from a word when it has only partially been processed, before integration into a syntactic structure.
- SWIFT (Engbert et al., 2005): Saccades triggered by random timer, inhibited by the difficulty of the fixated word. Saccades directed to word with most 'activation'; already identified words should have no activation.
- ***KEY POINT***: In both models first-pass reading times on a word should be determined before it is integrated into the sentence.
  - => An effect of our manipulation suggests attempt to integrate relative clause noun *prior* to integrating the relativizer.

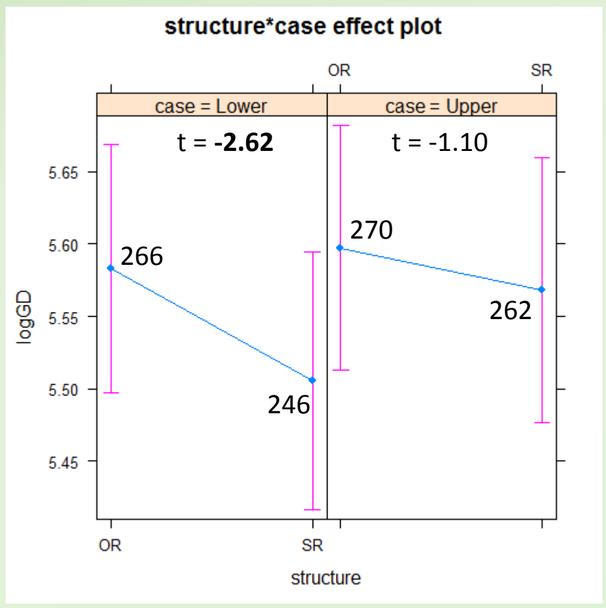
Method & Analysis

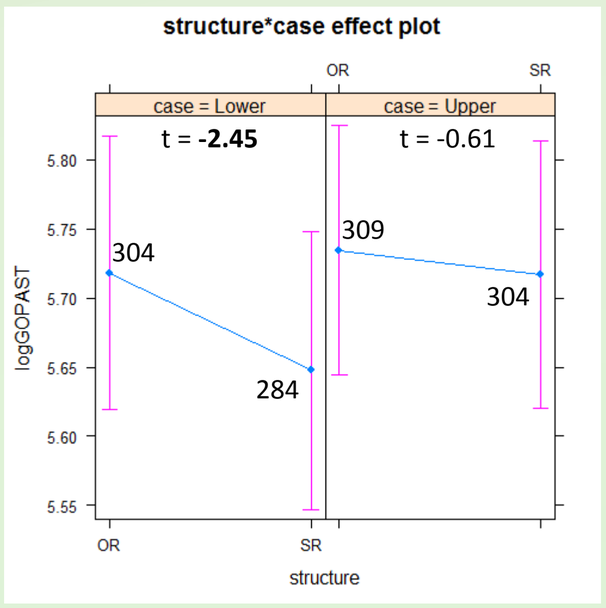
- Forty participants read 64 sentences containing an ORC or SRC.
- Eye movements tracked.
- Sentences presented in normal sentence casing (**1** and **2**) or UPPER CASE (**3** and **4**)**.** Tests whether ORC effects were due to capital letter in parafovea, as opposed to lexical processing.
- Relative clause noun and verb matched for length and orthographic frequency.
- We analysed a pre-target region and relative clause region using linear mixed models. Our models compared **1** to **2**, and **3** to **4**.

1. The thin guard who alerted Charlie was young.
2. The thin guard who Charlie alerted was young.
3. THE THIN GUARD WHO ALERTED CHARLIE WAS YOUNG.
4. THE THIN GUARD WHO CHARLIE ALERTED WAS YOUNG.

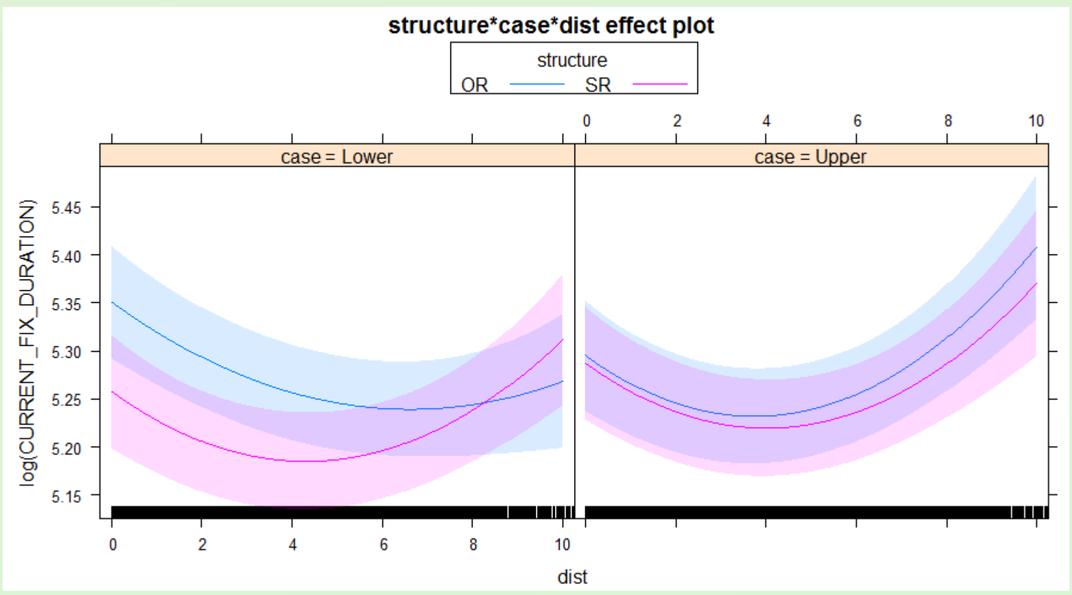
Results

- Gaze duration and Go-past time on pre-target region:





- Last fixation duration on the pre-target region, including interaction with fixation distance from the relative clause.



- Relative clause region: Smaller reading time effects for normal casing than UPPER CASING.

	Normal Casing		Upper Casing	
	SRC	ORC	SRC	ORC
	Relative Clause Region			
Total Reading Time	710	719	777	850
LMM Contrasts	-0.41		**-3.47**	
Regression Probability	0.07	0.17	0.09	0.14
LMM Contrasts	**-5.59**		**-2.92**	

Discussion

- When participants have a strong parafoveal cue for an ORC (i.e. in the sentence casing conditions), standard relative clause effects occur on a pre-target region.
- Crucially, the parafoveal noun may have been encoded prior to the integration of *who* into the syntactic structure to affect fixation durations in this region.
- Different explanations of ORC effects vary in how easily they can account for this finding.

Similarity-based interference (e.g. Gordon et al. 2001): A parafoveal cue indicating a second noun phrase interferes with encoding main clause noun phrase into memory. The identification of *who* is irrelevant to this process.

Traxler et al: May struggle to explain findings, with the integration of *who* into the syntactic structure being required for participants to experience ORC based difficulty.

Surprisal would require the sentence structure to be updated prior to the relativizer being integrated.

Lewis & Vasisth's left-corner parser would need to predict a verb as opposed to a noun prior to relativizer identification.

- Finally, our findings demonstrate that readers integrate cues from various sources during language processing (Martin, 2016).

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